



Presentation

FULL DETAILS AND TRANSCRIPT

Helping All Students Learn Algebra

Terman Middle School, California • November 2008

Topic: National Math Panel: Major Topics of School Algebra

Practice: Multiple Paths

Highlights

- Content of Introductory Algebra, including arithmetic in addition to algebra standards
- Approach to teaching algebra concepts that “stages in” arithmetic beginning with whole numbers, then negative numbers and fractions
- Purpose of lesson as communication about graphs, tables, equations, related terminology
- Description of activity for matching parts of a “function family”
- Description of activity where students are seated back to back and describe graphs to each other
- Observations about what students struggled with in the activities in terms of matching tables and graphs
- Building toward next lesson on intercepts
- Need to differentiate instruction and accelerate students who have begun to grasp algebra concepts

About the Site

Terman Middle School

Palo Alto, CA

Demographics

46% White

30% Asian

8% Hispanic

3% Black

14% Multiple/No Response

9% Free or Reduced-Price Lunch

2% English Language Learners

Terman Middle School, a grades 6-8 school, generally places students in heterogeneously organized classes; teachers rely on differentiation strategies to meet students' academic needs. Features of mathematics instruction at Terman Middle School are:

- Differentiated instruction within heterogeneous grouping;
- Two levels of pre-algebra at grade seven;
- Introduction to Algebra and Algebra as the two eighth grade courses;
- Emphasis on learning to communicate algebraically; and
- Accessibility of algebra to every student.

Full Transcript

Slide #1

Welcome to Helping All Students Learn Algebra.

Slide #2

Hi, I'm Paul Jorgens and I'm an eighth grade math teacher at Terman Middle School in Palo Alto, California. I teach three sections of algebra.

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The students in the Introductory Algebra course have some areas of math that they're still working on and so, as we teach the algebra standards, we need to be building their skills with integers, their skills with fractions, graphing, problem-solving, and we do that concurrent with teaching the algebra standards. At the

end of the year, we'll test all of our students on the algebra standards, and with the goal that they will all be successful and knowing that we'll have moved all the Introduction to Algebra students forward and that many of them will be successful.

Slide #4

So in the Introduction to Algebra class, what we found is that we need to—for instance, when we do equations, the students start solving equations where all the answers are whole numbers. And so we might start with multi-step equations, but we will start with whole numbers. And then we will bring in the negative numbers, and then we will bring in the fractions after that, so they have the skill of the equations first. And then we can work on their skills with integers, their skills with fractions to follow. If I don't do that, I can't diagnose, "Well, where is the struggle with inequalities? They are not getting the right answer." And they are not getting good feedback about where their struggle is. And so I have learned that, instead of starting with small inequalities and then making them more messy or complex, it is better to start with kind of multi-step inequalities but then start with results that are whole numbers and build in the negatives and the fractions later.

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So in this lesson, my goal was for students to communicate with each other about graphs and about graphs as they relate to tables, equations, and words. I think that's really important at learning algebra at any of the levels is that we have to utilize not only student's ability to write algebraically, but they need to really speak algebraically and develop that language of algebra. Coming into this lesson they had done some work with patterns. They could see a pattern, a consistent pattern in the table where there was a constant rate of change, that that would form a line when they graphed it. And so they had some vocabulary related to lines, like intercept or slope. They know the word quadrant, and so some of the vocabulary that goes with coordinate plane was necessary for them to be able to communicate with the other student.

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One piece of the lesson was for students to have all of these cards with tables, graphs, equations, and words, and then they had to sort them together and match them so the table and the graph and the equations and the words went together as a function family. I gave each group 24 cards. They had six equations, six graphs, six sets of words that matched a graph, and six tables. And so what I found was I needed to sometimes guide them because 24 cards on their table is a little bit too much information. And so sometimes, I would need to guide them by asking them questions like, "Well, can you find the y intercept? Can you match up the intercepts, or can you match up the pattern you are seeing?" In the end, all of the

groups were successful at matching the four.

Slide #7

We follow that with them back-to-back describing graphs to each other; one person seeing the graph, and one person drawing what was described. One student would be viewing a graph or a series of graphs on the screen and needing to describe to the student facing away from the screen what they were seeing. And so they were using vocabulary like steep or slant or intercept or parallel, all kinds of vocabulary that they had been picking up, now they were needing it to describe it to the person that couldn't see the picture.

Slide #8

Students struggled more with seeing the graph to match the table than I expected, and so I needed to follow that up with some more work with tables and graphs and matching them together and building a graph from a table. And then I found that if I gave them a graph and they could build tables from that, that they were starting to understand that this graph was this infinite set of points. We need to work from graphing from a lot of different angles with them, so that they're talking about it with other students, they are graphing it by points, they are graphing it by pattern. That's the skill that is really one of the most difficult to develop with eighth graders.

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We are going to use the equation solving skills that they have acquired previously, so now when they look at an intercept, they can figure out it algebraically rather than by looking at the table or by looking at the graph and trying to eyeball the intercept. So they have got this concept of what intercept is, but now we need to use their equation-solving skills to take the next step. The closure was really also the preview for next week, telling them how they're going to use some of the vocabulary and skills that they were working with in graphs, equations, and tables, and where we are going next week. And so I presented problem called co-linear trio that they would be seeing and told them how what we had done not only in that lesson, but in the few lessons leading up to it, were going to help us be successful for where we are going next week.

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One of the things that I found in the Introductory Algebra course is a lot of times all of a sudden students will start getting it and really making fast progress. And so, I have to build opportunities for them to join the other group of kids in ninth grade. And so differentiating by sometimes giving them different homework problems or sometimes asking them to do a little bit further in a problem-solving context so that they can

have that chance because at some point, for some of the students, it's going to become easy for them. And they can have that opportunity to move up.

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To learn more about Helping All Students Learn Algebra, please explore the additional resources on the Doing What Works website.